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SEPARATION AND PHYSICOCHEMICAL ANALYSIS OF IODINE CONTAINED IN HAUDAK GROUND SALT WATERS ON THE BASIS OF STARCH.

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Abstract: Khaudak (Uzbekistan, Surkhandarya Region) groundwater contains high concentrations of various salts, and iodine ions are present in the form of potassium iodide. They are first oxidized under the influence of special oxidizers. Free iodine was precipitated by forming a complex on the basis of starch and its composition was observed using the scanning electron microscopy (SEM) method. According to it, it was proposed that a complex compound with starch iodide was formed.

Key words: Khaudak underground brines, Uzhkyzil underground brines, iodine, petroleum waters, potassium iodide, potassium iodate, hexamethylenediamine, scanning electron microscopy, infrared spectroscopy.

Introduction: Iodine can be considered as one of the most important and important industries in the world. Nowadays, the demand for it is increasing all over the world, because the importance of iodine in medicine, that is, in human life, is very important, its reserves are few, and most of the existing reserves are scattered in the form of compounds in the ground, ocean and sea water. and focusing on the processes of concentration and separation as one of the important productions is recognized as one of the urgent problems of today.

Literature review. A relatively high iodine content is also characteristic of saline underground oil waters. Groundwater is widespread in nature, and the concentration of iodine in a multicomponent solution of salts is slightly higher than in the normal composition. Iodine reserves are concentrated in 20 mines in the territory of the CIS countries. All these deposits are iodine-bromine (16) and iodine (4) deposits, according to the contribution of underground water. Deposits of iodine and iodine-bromine waters have been explored in Russia, Azerbaijan, Turkmenistan, Uzbekistan and Ukraine. The total proven reserves of groundwater containing iodine are equal to 1 million m3 / day, with an average iodine content of 30 mg/l. The reserve of Turkmenistan is 40% of all reserves of the CIS in 4 deposits of iodine-bromine waters; Russian reserves - 6 mines (34% of CIS reserves); Azerbaijan - 6 mines (22%), Ukraine - 1 mine (3%), Uzbekistan - 3 mines (1%).[1]

The amount of iodine in sea mud is ten times higher than in water and reaches 0.002-0.01%, and in oil-related waters it reaches 0.01%; Chilean saltpeter deposits contain about 1% iodine. The concentration of iodine in phosphorites reaches 280 mg/kg, and in lignites up to 6 mg/kg. Table salt obtained from sea water contains 0.1 mg of iodine/kg of salt, rock salt - 0.25 mg/kg, potassium salts - up to 0.06 mg/kg. In addition to the reasons mentioned above, the lack of iodine in salt deposits is due to the lack of ability of iodide ions to isoform the position of chlorine in the crystal lattice [2].

The annual production of iodine in the world is 30 thousand tons. Production figures for the United States were weak, but accounted for about 5% of global production. Of the world iodine production, Chile (66%) and Japan (32%) are the largest producers [3].

Bound waters are promising for iodine production if the iodine content is at least 10-18 mg/l. In the development of iodine extraction technology based on iodized groundwater containing iodine compounds, it is necessary to justify a number of scientific solutions in the following directions: - determination of the optimal technological parameters of the kinetics of iodine ions and the oxidation mechanism during drilling. -water in an acidic environment; selection of oxidizing agents and determination of optimal process conditions for precipitation of iodine from iodine concentrates, as well as development of molecular crystalline iodine separation technology [4, 5].

In the territory of our republic (Uzbekistan), a number of industrial iodine underground waters were found, mainly in the Fergana, Bukhara-Karshi and Surkhandarya artesian basins and on the Ustyurt plateau. They are characterized by increased concentrations of iodine, cesium, rubidium, strontium and bromine. Calcium iodate, potassium iodate and potassium iodide refer to iodine-containing compounds that are added to animal feed and salt to prevent medical diseases due to the lack of iodine and iodide ions in the body [6].

In the Surkhandarya artesian basin, 3 deposits of hydrogen sulphide and iodine waters were identified and studied, their formation is also related to oil deposits and oil-bearing rocks: Uchkizil, Khaudag, Kakayti and Ortabuloq - objects containing iodine and bromine. The amount of iodine in the waters of the Surkhandarya basin is 17.4-24.34 mg/l, bromine 313.2-426.4 mg/l, pH 5.1-6.7, temperature 39 - 76°C, and mineralization 142.9-283.0 g/l depending on the deposit. Kattakum-2 well of Khaudag field, Uchkyzil underground salt water deposits, Kakayti and Ortabulok underground salt water deposits according to the type of anion: bicarbonate, sulfate, chloride and according to the cation: calcium-magnesium - the concentration of sodium cations is high. According to the content of iodine and bromine, these waters are industrial waters [7].

The elemental composition of hydrothermal groundwater was studied. According to it, the salt water of Kattakum-2 well of Khaudag mine was determined using SEM (scanning electron microscopy) (scannedelectron EVO MA 10), and the composition of films was determined using EDX (OxfordInstrument) energy dispersive element analyzer (Table 1).

Table 1

Chemical composition of dry salt obtained from underground water.

№	Element	Weight, %	Sigma, weight, %
1	O	30.52	2.09
2	Na	6.23	0.61
3	Mg	3.38	0.47
4	Cl	41.79	1.66
5	Ca	15.86	1.10
6	Br	0.61	0.63
7	I	1.61	1.43

The results of the analysis of the scanning electron microscope with an energy dispersive elemental analyzer showed that the elements I2 and Br2 were 1.61 and 0.61 percent, respectively, for the spectrum of sample 52.

The results of the analysis of the scanning electron microscope with the energy dispersive elemental analyzer showed that the elements I_2 and Br_2 were 1.61 and 0.61 percent, respectively, for the 52nd spectrum of the obtained sample (Fig. 1).

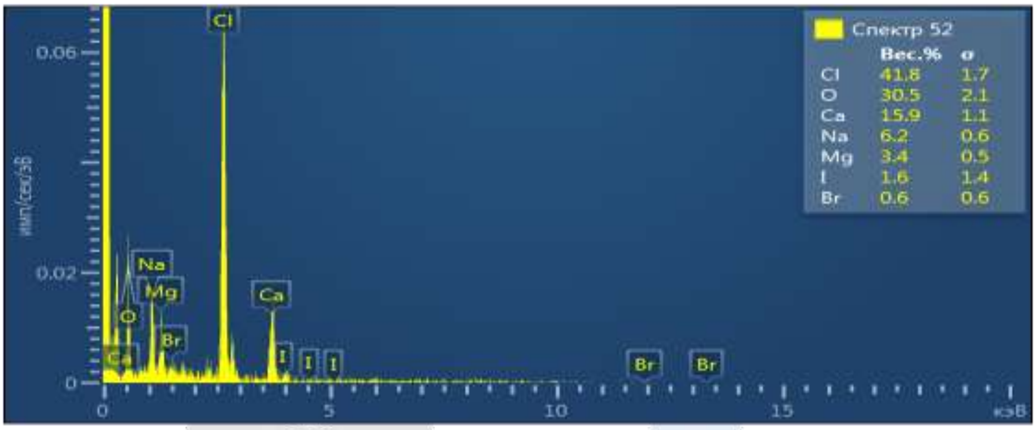


Figure 1. Elemental analysis of salt extracted from the brine of the Kattakum-2 well in the Khaudag field [8].

The fact that the concentration of iodine in nature changes depending on the conditions shows that it is one of the important things to pay attention to its isolation even in the case of complex compounds. For example, a sample of the pyrroloperylene-iodine complex was subjected to a dry nitrogen purge at TGA below 25 mL/min. The ramp rate was 10 °C/min to 650 °C. A weight loss corresponding to the volatilization of iodine is seen, followed by complete sublimation of the organic part [9]. Iodine complex compounds in the form of biocides are used in medicine for a wide range of procedures [10].

The concentrations of various salts in the composition of Uchkyzil and petroleum waters are very high, and the iodine ions present in it are in the form of potassium iodide, from which 10 ml of 0.02 N solution was obtained. Oxidation was carried out by adding 1 ml of 0.2 N solution of FeCl3 to this solution at room temperature. As a result, a reddish solution of iodine was formed. An equivalent amount of aqueous solution of hexamethylenetetramine was added to the liberated iodine. As a result of the reaction, a reddish-brown cloud was formed and settled. The composition of the precipitate obtained was examined using the infrared spectroscopy method (Fig. 2).

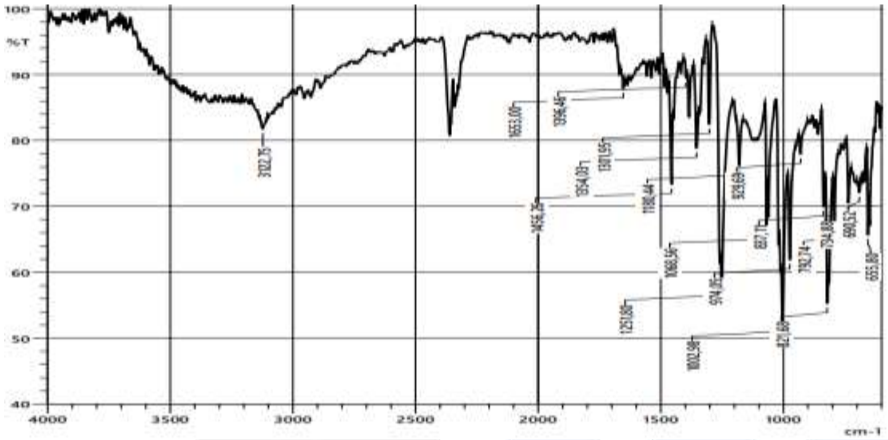


Figure 2. IR spectrum of urotropin precipitate of oxidized KI solution

The same experiment was carried out in Uchkyzil underground salt water, i.e. instead of KJ solution, salt water was used, and the IR spectrum of the resulting precipitate was obtained (Fig. 3).

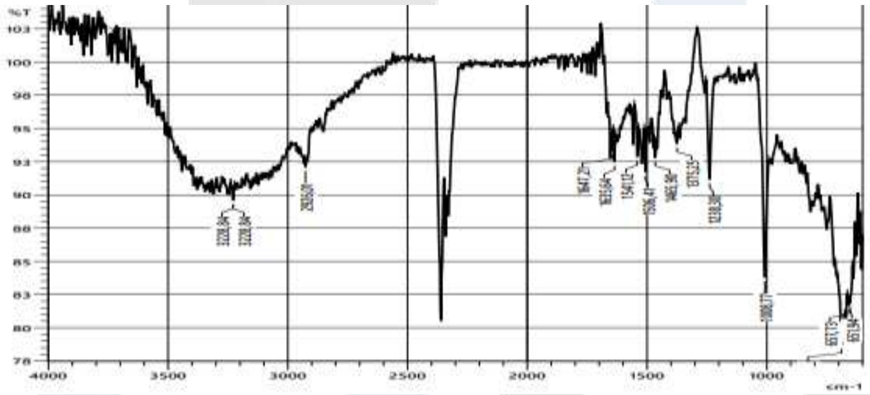


Figure 3. IR spectrum of urotropin precipitate formed by oxidizing KI contained in the trident water

In this picture, the bands of symmetric valence vibration of groups in almost the same area as the spectra of Fig. 2 taken above, as well as the vibration of iodine anion groups, are observed. From these indicators, it was suggested that a coordination compound with hydrogen iodide was formed in the compound [11].

Experimental part. The essence of the proposed method for separating iodine in the form of a complex compound by precipitation of highly mineralized (Khaudak underground) water is that it is obtained from a salt water source, contains iodine and various anions and cations with a very high concentration. 670 ml of water was placed in a flat-bottomed flask, and in order to oxidize the contained iodine ions, 35 ml of a 0.2 normal solution of iron (III) chloride salt corresponding to the content of iodine was added and slowly mixed with a stirrer at room temperature, and as a result, in a short time, the entire the surface of the solution turned pale yellow, i.e. the color of oxidized iodine, and 15 ml of 1% starch paste solution was added to it, and the reaction was continued by stirring at room temperature. The general mixing process, i.e., 0.2 hours is spent on oxidation and precipitation. The mixing process was carried out at low speed.

After mixing, the iodine complex formation process between the oxidized iodine salt water and starch goes to the end, and the total solution is kept in a calm state for 3 hours, occupying the entire volume of the container, until the sediments are formed. No special conditions or temperature are required for this precipitation during 3 hours, it is left under normal conditions at room temperature. After the precipitate forms and sinks to the bottom of the vessel, the clear part on top is expelled through the separator. The remaining dark black sediment, i.e. iodine concentrate (1-1.5% of the total solution level) was passed through a filter and dried at a relatively low room temperature, i.e. in the range of 20-30 0C. The precipitate was in the form of a complex flocculate precipitate, and it spent a little more time passing freely through the filter.

Analysis and results. Figure 4 shows the image of the complex elemental composition of the iodine absorption in salt water obtained by the scanning electron microscopy (SEM) method.

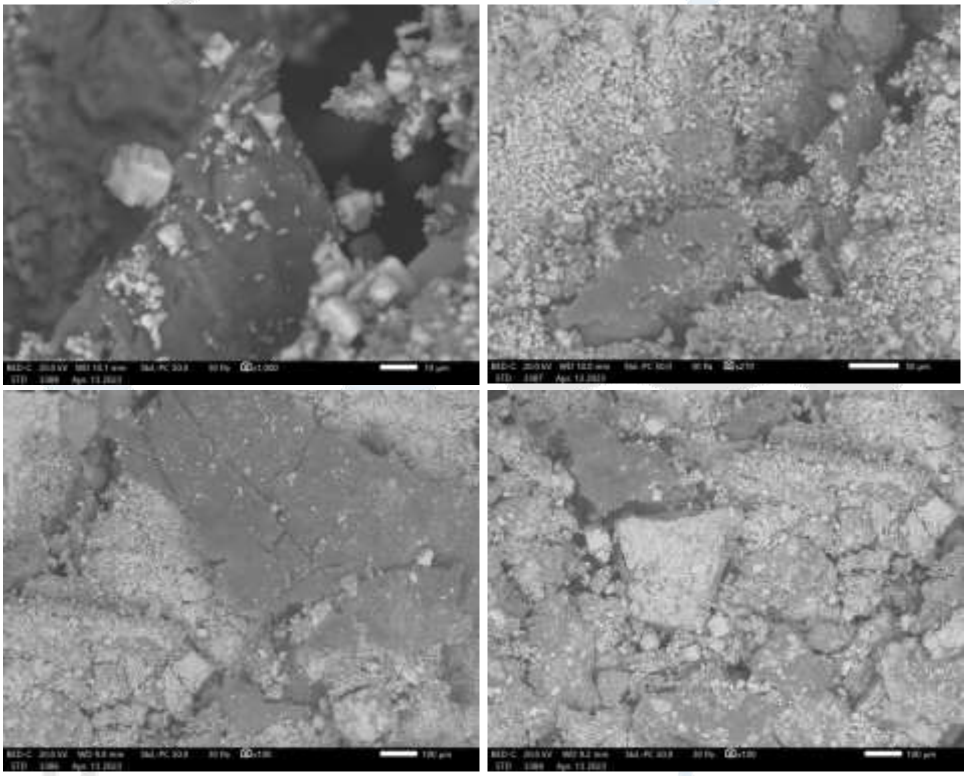
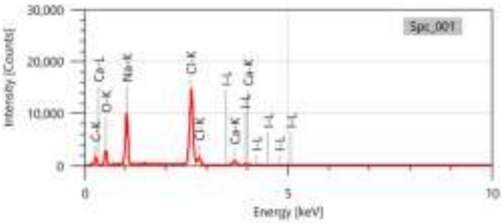


Figure 4. SEM images of iodine-starch complex

According to the analysis of the amount of iodine in the initial salt water sample (Khaudak underground salt water), 723 mg of dry complex was separated from 670 ml of salt water, and it was determined that 0.98% of it consists of iodine. The amount of iodine in the initial sample was 21.32 mg/l, and 10.575 milligrams and 49.6% were separated by precipitation in a complex manner (Fig. 5).



Display name	Standard data	Quantification method	Result Type
Spc_001	Standardless	ZAF	Metal

Element	Line	Mass%	Atom%
C	K	34.49±0.21	51.11±0.31
O	K	18.99±0.15	21.12±0.16
Na	K	17.87±0.08	13.83±0.07
Cl	K	25.96±0.09	13.04±0.04
Ca	K	1.71±0.01	0.76±0.01
I	L	0.98±0.04	0.14±0.01
Total		100.00	100.00
Spc_001			Fitting ratio 0.0135

Figure 5. Elemental composition of iodine-starch complex SEM image.

Conclusion. As a result of the conducted research, the complex precipitation of iodine in the content of underground saline waters with the participation of starch was isolated. When analyzing the composition and quantity of the iodine precipitate extracted by the synthesis method using scanning electron microscopy and elemental analysis methods, it can be seen that almost half of the iodine contained in the original Haudak brine has been absorbed. When forming the iodine-starch complex, it is possible to obtain sufficient information by varying the ratio of salt water and reagents, and by changing the amount of iodine in the solution.

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